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Notes on Plant Diseases in Virginia Observed in 1913 and 1914

BY

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NOTES ON PLANT DISEASES IN VIRGINIA OBSERVED IN 1913 AND 1914.[1]

By Howard S. Reed and C. H. Crabill.

Alfalfa.

Violet Root Rot *(Rhizoctonia medicaginis).*—Alfalfa plants were sent in from Daleville, Botetourt County, with the report that many such plants were dying in patches all over a two-year-old field. Examination showed them to be infected with *Rhizoctonia medicaginis,* which causes rotting of the root. The roots were covered with a thick mat of violet mycelium which also invested the outer layers of the bark.

Myriads of almost black, minute clumps of this mycelium apparently of a sclerotial nature dotted the surface of the bark. The purple color of the root extended upward to the surface of the ground and downward seven inches or more. How much more we cannot say, because the roots were cut off at this depth. The bark separated readily from the diseased roots.

Yellow Top.—This disease of alfalfa came into prominent notice in the season of 1914 when the climatic conditions were not favorable for plant growth over a large part of the State. The first cutting of the crop usually escapes, but the successive cuttings may suffer more or less severely especially in unfavorable seasons. Young alfalfa plantations suffer worse as a rule than those which have attained an age of three or more years.

Affected plants may be identified by the pale yellow color of the apical leaves, which in time becomes general on the leaves of the upper part of the plant. In distinction from the leaf spot caused by *Pseudopeziza medicaginis,* these yellow leaves do not fall, but remain firmly attached to the plants. There is often a pronounced purple color on diseased plants, which becomes more or less general when such plants are cut and cured for hay. The affected plants usually grow poorly and a continuance of the disease is fatal. The disease is undoubtedly identical with that described by Stewart, *et al.,* in New York.[2]

The following observations have been made in preliminary study of the disease in this State:

(1) Yellow Top presents none of the common symptoms of parasitic infection. It appears simultaneously over extended areas in the fields. Unless yellowing is due to the insects mentioned later, the disease does not begin at one place and spread to contiguous areas.

[1]Paper No. 35 from the Laboratories of Plant Pathology and Bacteriology, Virginia Agr. Exp. Sta.

[2]N. Y. Agr. Exp. Sta. Bul. 305. 1908.

(2) The disease is worst in dry summers. Fields on the uplands suffer more than those on lowlands. Where rain was plentiful, there was comparatively little disease. The last cutting of the season was usually free from the disease because it received the benefit of the autumn rains.

(3) The disease is not due to a lack of lime. At the Experiment Farm at Staunton more yellow top was found on plats receiving four tons of lime per acre than on plots receiving two tons, because the former were on the most elevated part of the field.

(4) In the Eastern part of the State, yellow top was found in many places associated with girdling of the stems close to the ground by Tree-Hoppers (Membracids). This injury usually began adjacent to grass land and gradually spread from there.

Fig. 1.—White spot of alfalfa.

(5) In a few places, the yellow plants were found in the depressions in the fields. In such places it appeared that the plants had been started to active growth by the accumulation of the run-off following brief showers. The quantity of water thus afforded was only sufficient to start increased

growth without being able to support it for long. After the supply was exhausted the plants were worse off than before, and the yellow condition developed.

It is probably true that a variety of causes may be responsible for yellow top, and that many unfavorable factors may cause injury which is shown in this way.

White Spot.—This is a trouble due to an undetermined cause. Although the losses from this disease are small, it occurs in many sections of the State. White, semi-translucent, usually rectangular spots occur on the leaves, principally on the distal portions. (Fig. 1.) Affected plants usually show the white spots on nearly every leaf while adjacent plants may be entirely healthy. This trouble is most noticeable early in the season.

Anthracnose *(Colletotrichum trifolii)*.—At Williamsburg, James City County, many alfalfa plants were found diseased with a Colletotrichum, probably *C. trifolii* Bain & Essary. The lesions which occurred on the stems were oval to obovate and had a slight furry appearance. Occasionally such spots were confluent and caused the stems to fall over at that point, due to girdling.

Apple.

Blister Canker *(Nummularia discreta)*.—This disease, also known as Illinois apple canker, has reached Virginia. Its depredations have not yet

Fig. 2.—Grimes apple tree killed by collar blight. The canker is two years old and has completely girdled the tree.

been of serious proportions but reports and specimens have come in from Loudoun, Orange, Frederick and Montgomery counties.

Collar Blight *(Bacillus amylovorus)*.—Collar blight is plainly a form of fire blight caused by *Bacillus amylovorus*. It occurs in all the important apple growing sections of Virginia and is especially destructive in the Shenandoah Valley, where it works havoc on Grimes and Ben Davis. Occasionally even York Imperial is killed by collar blight. Most of the other varieties common in Virginia suffer but little. Some seem to be entirely immune. Losses in Ben Davis and Grimes orchards have been relatively enormous when we take into account the fact that a ten- or a twenty-year-old tree may be killed outright in a single season. About three years, however, are usually required to kill a large tree.

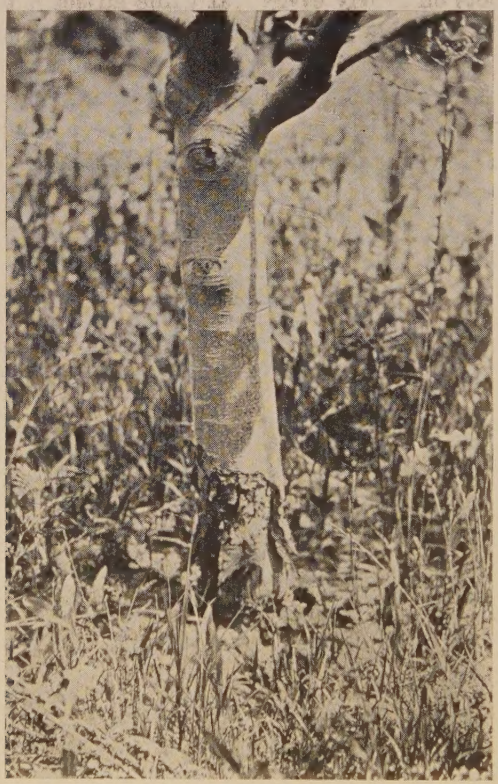

Fig. 3.—York Imperial apple tree affected with collar blight. This canker has spread slowly. The bark is completely dry and is sloughing off at the centre of the wound.

The collar blight usually starts on the east or northeast side of the trunk just above the soil surface. From there it spreads upward and outward, sometimes rapidly, sometimes slowly, but almost surely with fatal results. Never have the writers seen a tree which had recovered from collar

blight, although in many cases precautions were taken to prevent the spread of the parasite. Collar blight may be identified with certainty by the slightly depressed, discolored bark which has a decidedly sour, fermented odor when freshly cut.

The fact that the collar blight nearly always starts on the east or northeast side of the tree leads to the presumption that weather conditions in winter have a bearing upon the conditions necessary for infection. Cracks in the bark are probably inoculated by insects which have recently visited "hold-over" cankers from which the bacteria are oozing.

It is seldom that the orchardist notices collar blight until the evidence of its presence is manifested by the death or poor condition of the top of the tree unless he makes a special examination of all his tree trunks in the spring.

Attempts have been made by some orchardists to check collar blight by cutting away infected bark and painting the wounds. So far as we know, little success has attended these attempts. In all cases observed by the writers the blight continued to spread. Further experiments with disinfectants may ultimately yield results of practical value. Since blighted water sprouts may convey the organisms to the tree trunks, a prompt removal of the water sprouts is advisable.

At present all measures must be sanitary and preventive. The removal of all blighted wood from orchards as soon as it can be discovered is highly important. More necessary still in many cases is the removal of pear trees in or near the apple orchard. Instances are on record where the removal of adjacent pear trees had almost completely done away with both collar blight and twig blight in apple orchards. Pear trees, which are very susceptible to blight, constitute a source of infective material and are a menace to nearby orchards.

Crown Gall *(Bacterium tumefaciens)*.—In many sections of Virginia crown gall is a serious disease especially in nursery stock. Even in old orchards it causes great losses. Most of the old trees which are now dying, however, were infected when set. They are, for the most part, from fifteen to twenty years old. They have made poor growth and are only half as large as healthy trees of the same age. Usually a tree infected with crown gall lives for 10 to 20 years and then dies rather suddenly.

Death results in nearly all cases from a decay of the gall itself, followed by a decay of the root system and trunk. Such trees usually succumb during the winter. Many put forth in spring a weak covering of small leaves and flowers which soon wither away. This slight attempt at growth is made on food materials stored up in the twigs and branches, since in many cases the tree is completely dead at the base.

A few trees, however, die while the gall is still alive. In the majority of such cases the gall is on only one side of the tree and that dies first. Apparently the fibrovascular bundles are destroyed or so altered or contorted by the gall tumor that the transpiration stream is interfered with and all the wood above, which should be supplied by this stream, dies. With one side of the tree killed by crown gall it is only a matter of a short time until the whole tree is involved. If the crown gall itself does not cause the ultimate death of the tree, saprophytic fungi or wound parasities soon do so by destroying the whole root system.

Flap Tumor.—In two separate instances, one at Blacksburg and one at Hollins, Virginia, we have found tumors of a peculiar and interesting character on apple limbs. Lacking a designation, these growths have been called " flap tumors " on account of their shape.

The tree at Blacksburg, of variety unknown, exhibited an almost incredible number of these tumors in all stages of development. Accompanying them were a few typical aerial crown gall lesions. The largest and most

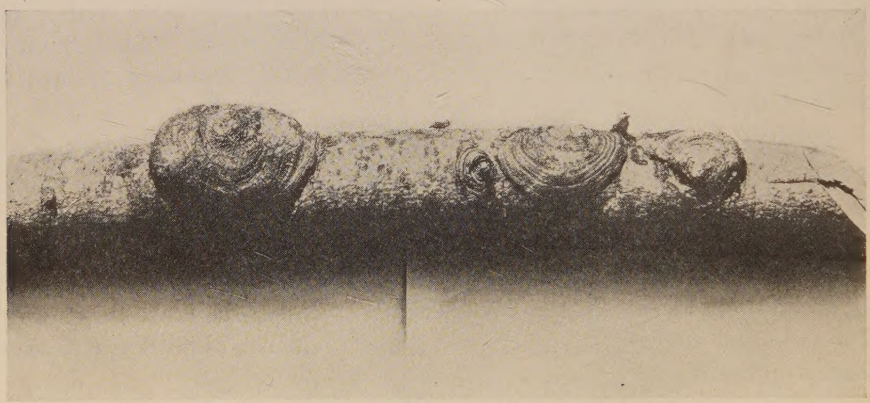

Fig. 4.—Flap tumors on an apple limb.

decidedly characteristic flap tumors occurred on the upper sides of branches three or four inches in diameter. (Fig. 4.) They may be described as shell-shaped flaps of hard, solid, apparently healthy wood, growing out from and extending partly around the branch that bears them. Fig. 5 shows one of these flap tumors in cross section. Enough of the annual rings have been included in the sketch to show that from one side of what is apparently a wound or disease lesion a rolling flap of wood has been put out, extending itself annually by addition of new wood and bark to the outer surface and to the margin. Some of the oldest flap tumors examined showed their age to be more than fifteen years. A blackened wound, surrounded by dense, hard, woody tissue, extends from the base of the flap downward

sometimes to the pith of the limb as shown in the sketch. Younger ones in all stages of growth were distributed over limbs and twigs, even out to wood only two or three years old.

A superficial examination shows that there are all gradations between young flap tumors and young crown gall lesions. The former appear to arise in nearly all cases from partly healed wounds apparently identical with cankered snowy Tree Cricket wounds. The latter arise as smooth pinkish tubercles under the bark which finally break through and become black and warty. The crown gall lesions may or may not have a blackened core,

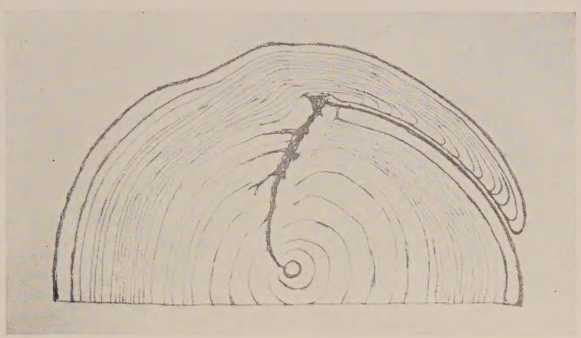

Fig. 5.—Flap tumor in cross section.

but typical flap tumors always have such a core. In the intermediate stages of development it is difficult to distinguish the one from the other. Some specimens cannot be classified certainly with the most careful study. In reactions to hot saturated bichromate of potash solution and to stains the elements of flap tumors and crown gall lesions are the same.

Whether flap tumors are due entirely to the growth of healing tissue in an attempt to close old cankered Tree Cricket wounds or whether the crown gall organism has a hand in the trouble it is difficult to say. The similarity of the two types of tumors in the intermediate stages and their unlikeness in the initial and final stages are confusing. Those tumors which arise as mere elevations under the bark soon becoming black and warty, are undoubtedly true crown gall. It is probable that some of the other tumors arising from Tree Cricket injuries finally become warty and black, thus forming what on the surface look like typical aerial crown gall lesions, and which beneath have the blackened core noted above, while others develop the flaps of wood already mentioned.

A complication of agencies may act to bring about the flap tumors. Tree Cricket injuries, according to Parrott and Fulton[1] often are cankered by a fungus—probably *Leptosphaeria coniothyrium*, causing a disk of bark to

[1]N. Y. Agr. Exp. Sta. Bul. 388. 1914.

peel off exposing a partially healed wound beneath. The illustrations of such wounds given by these writers agree closely with our specimens showing the initial stages of flap tumor or rather the type of injury from which the flap tumors arise. It is possible that such a wound may become a harbor for the crown gall organism if it is present in the tree and either a warty lesion or a flap tumor may be consequently developed, depending upon the relative vigor of the host and the parasite at that point. Perhaps the stimulus given when the tumor is in its initial stages starts the growth of the flap, which like any other part of the tree then continues to grow even after the causative organism has died out in that particular region.

Punky Pulp of Ben Davis.—This disease, noticed only in 1914, is characterized by small punky or corky lumps interspersed throughout the pulp of the Ben Davis apple. In addition, the fruits are smaller than normal, punky and brittle, and have a tendency to be divided into longitudinal sectors somewhat like a cantaloupe. The lenticels are very prominent. The fruit is tasteless and entirely unfit for consumption.

This trouble is due to dry weather. It was confined to excessively dry soils in the regions of the State most affected by the drouth.

Root Rot.—Root rot is at the present time one of the least controllable of all apple diseases in Virginia and is also one of the most destructive, even to growers who practice orthodox methods of sanitation and management.

Fig. 6.—Stumps of young apples which have been planted in ground where former trees had been killed by root rot.

Trees affected with this disease may die at any age but the greatest numbers lost are from 10 to 15 years of age. Many trees come to maturity in ap-

parently perfect health, but die suddenly from this trouble as soon as they begin to bear fruit. The orchardist thus loses his ten or more years of labor and expense as well as the tree. Further than this, if another tree be planted where the dead one was removed the chances are about two to one that it will die also. In many orchards replants have died of the root rot within two years after being set and from 30 percent to 60 percent died before they were eight years old. (Fig. 6.)

Fig 7.—Apple tree affected with root rot. The unthrifty condition of the top is an indication of approaching death.

The first indication of the disease is a cessation of growth followed by a loss of some of the foliage, then by the death of a portion of the top of the tree. (Fig. 7.) An examination of the root then reveals a deplorable condition. All of the roots, except one or two on the live side of the tree, will

be dead, punky and brittle and filled with the fine white mycelium of a fungus. The tree can be readily pushed over in nearly every case. The roots break off short near the stump. Usually the disease begins on the roots situated deepest in the soil, and works upward. The deep lying roots are often completely destroyed while the more superficial roots are still sustaining the tree. Eventually, however, all the roots are killed and decay. Often

Fig. 8.—Longitudinal section of the stump of an apple tree killed by root rot.

one side of a tree becomes affected long before the other does, especially if the root system is divided into two or more divergent portions. The wood above the killed root dies first, becomes shrunken, and brown. The outer bark becomes checked with cracks and peels off in thin scales, the juncture between dead and healthy bark is sharply defined, often marked by a deep crack which extends to the sapwood, and the branches and twigs above all die and shrivel. (See Fig. 8). One-half of a tree may thus be completely dead while the other remains for a time quite healthy. The death of the upper parts of the diseased half is no doubt due to the cutting off of the

water supply from the soil. Sometimes, however, the mycelium of the fungus, which is always present in the root of root rot trees and which is presumably the cause of the trouble, is found in the wood of the trunk for some distance above the ground. This is especially true on wet soils. The symptoms of root rot do not usually become manifest until death is close at hand.

Our observations and reports from orchardists have brought to light the following important facts: (1) Root rot is more prevalent on new ground than on ground which has been cultivated for some years before the orchard was set, especially where the soil contains partially decaying wood, stumps, etc. (2) Root rot is present on high gravelly and low loamy soils alike. (3) The white mycelium of a fungus is a constant accompaniment of the disease. (4) In many orchards several adjoining trees in a group contract the disease at about the same time. Sometimes eight or ten trees will die around the first to succumb. (5) In Virginia, York Imperial is most susceptible to the disease, Ben Davis, Stayman Winesap, Black Twig and many others suffer occasionally.

No sporophores of the fungus found in rotted roots have been encountered, although they have been sought for assiduously. Black rhizomorphs similar to those ordinarily produced by *Armillaria mellea* have once been found. There seems to be little doubt, however, that the white mycelium found in rotted roots is the ultimate cause of the death of the tree. It may be a wound parasite following aphis injury, crown gall, borers, barking by implements of cultivation, etc., but as to this, no definite statement may be made at the present time.

Further studies on this disease are under way.

Skin Crack of the York Imperial.—This disease is, so far as observation goes, confined to the York Imperial. In some orchards as much as 50 percent of the fruit is affected. 10 percent to 30 percent of injured fruit is common. Until the summer of 1914, this trouble has been noticed only very rarely in dry seasons.

The following observations have been made upon the disease: Early in September, tiny sunken cracks appear in the skin of the fruit, each crack surrounded by a narrow red-brown margin. Most of the cracks are less than 2 mm. long and extend latitudinally. Some, however, are larger and extend in other directions. The fruit looks as if it had grown too fast for its skin, which was stretched to bursting. There may be many or few of these tiny cracks, usually many. Often a large number of these become continuous by spreading and give a grayish scabby appearance to that portion of skin. The skin crack is confined almost entirely to the shaded side of the fruit and is worse on the shaded portion of the tree. The red cheeks

of the fruits which are exposed directly to the sun's rays are free from cracks.

The season of 1914 was marked by a drouth from May 6 until August 1 over nearly all of the State. The Northern part of the Shenandoah Valley which had no rain until the middle of August suffered worst. It was in these drouth-affected localities that the skin crack was prevalent. In more favored regions it was absent. Even in Northern Virginia trees on low ground where an appreciable amount of moisture was present in the soil bore perfect fruit, while on trees on high ground, especially where the soil was gravelly, the fruit was badly affected. The trouble was found chiefly on the fruit of trees less than fifteen years old. In the vicinity of Middle-

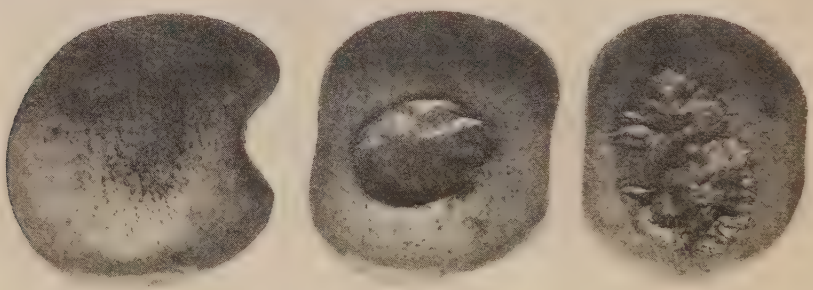

Fig. 9.—Skin crack of York Imperial apple and the typical rot which may follow it.

town, Virginia, in the centre of the drouth-affected area the apples grew but poorly and remained very small until the drouth broke in August. The fruits then increased remarkably in size in a very short time. By September 1 the skin crack was evident in the York Imperial orchards.

Zschokke[1] has pointed out that lenticels on the apple arise by a stretching and splitting of stomata due to the rapid growth of the young fruit. It does not seem impossible that the skin on the shaded side of the fruit may be actually stretched to bursting by the unusually rapid multiplication and growth of pulp cells due to sudden increase in the water supply. This, indeed, appears to be the nature of the injury. Microtome sections of skin crack show that the rupture of the epidermis stimulates a reaction in the cells of the hypodermal parenchyma beneath. By rapid division these cells build up a barricade of cork which protects the underlying pulp. (Fig 10.) Drying is perhaps the stimulus which results in the formation of the cork

[1]Zschokke, A. Ueber den Bau der Haut und die Ursachen der verschiedenen Haltbarkeit unserer Kernobstfruchte. Landw. Jahrb. der Schweiz. 11:153. 1897.

layer. In a few cases sections show that fungi have penetrated the cracks before a protecting layer of cork was formed. Mycelium is more or less abundant in the degenerating cells immediately beneath the crack and no cork layer is produced.

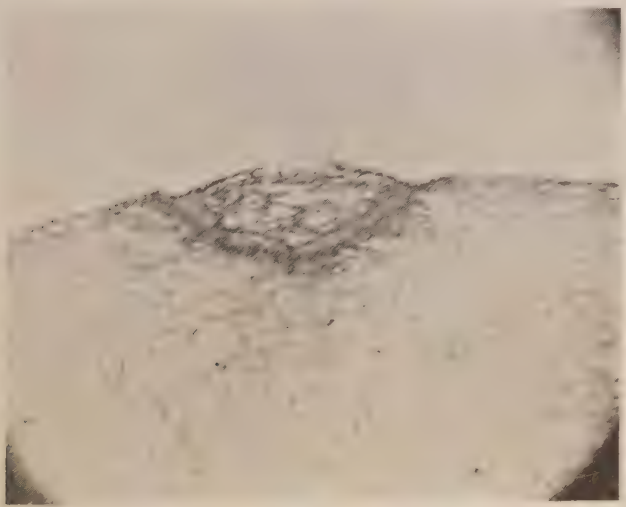

Fig. 10.—Section of skin crack showing the cork barricade which partially heals it.

The evidence seems to indicate that this disease is physiological, due to sudden increase in water supply. Careful inoculations from the tissue beneath the cracks and microscopic examinations show that in the initial stages no organisms are present. Sprayed and unsprayed fruits are affected alike. Fruits slightly or moderately affected with skin crack have been held in cellar storage for several months. Although there was considerable loss of water and consequent shriveling of the cracked sides of the fruits no rot whatever has developed.

A soft place rot caused by *Alternaria malí* Roberts is the almost constant attendant of the later stages of bad cases of skin crack. Such rot first appeared about September 10. Out of twenty inoculations from many typically affected fruits, twenty pure cultures of *A. malí* were obtained. It is evident that in some cases rot fungi may enter the skin crack as soon as it is formed, kill the pulp cells beneath, prevent the formation of a protecting cork layer and produce rot. Whether the cork layer can always protect the fruit from invasion of fungi is doubtful and it is likely that much of the Alternaria infection takes place through the cork some time after the epidermis has been ruptured.

Fig. 9 shows one apple with skin crack and two with the Alternaria rot which follows.

The York Spot.—Large losses have been sustained from the York Spot, even in well sprayed and well cared for orchards, especially during the season of 1914. In its early stages the York Spot is apparently identical with the Jonathan or Baldwin fruit spot, which is common on Jonathan, Baldwin, and Black Twig, and is occasionally found on Grimes and several other varieties. The typical Jonathan or Baldwin spot in Virginia is confined to corky pits, just beneath the skin of the fruit, seldom greater than 5 mm. in diameter. Ordinarily the actual injury to the fruit is small, although the appearance of the fruit hurts its marketability. The spots seldom spread or decay in cold storage. Occasionally the skin over a corky pit dies and gives entrance to decomposing organisms which ultimately destroy the whole fruit.

On the York Imperial such is not the case. The disease first makes its appearance in August as slightly sunken dark-green spots. At this stage the tissue immediately beneath the skin is much greener and denser than that surrounding and is tightly attached to the skin. Beneath this hard green disk is a roundish mass of brown corky tissue, the cells of which are brown-walled, hard to tease apart and very rich in starch. This form of

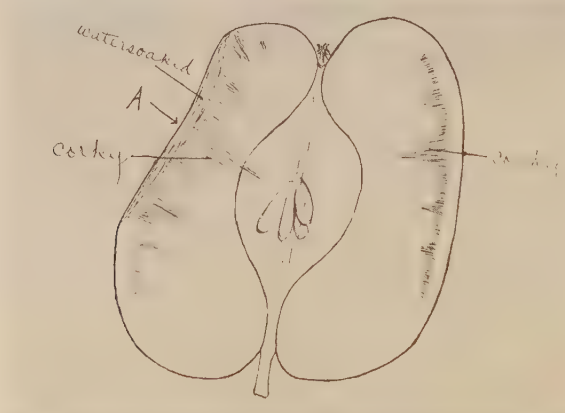

Fig. 11.—Diagramatic section of a York Imperial apple in advanced stage of the York Spot.

the York Spot looks very much like hail injury. No mycelium has been found in this tissue. Nearly a hundred inoculations have been made by thrusting bits of this tissue, cut out with a sterile knife, into suitable culture media. No organisms whatever grew from the spots.

Stained microtome sections show that in the corky tissue beneath the skin many of the cell walls have disintegrated, forming relatively large cavities in the tissue. No mycelium is apparent.

Up to this time the York Spot is apparently identical with the Jonathan or Baldwin fruit spot. As the season advances, about September 1, the corky condition begins to spread, extending itself under the skin about 2 mm. from the surface and around the apple latitudinally faster than longitudinally. The affected area becomes much depressed and takes on a characteristic water-soaked appearance. It is soft to the touch and becomes brown in color. The cells which give the water-soaked appearance lie just beneath the skin and outside of the corky layer. (Fig. 11.) Although they appear to be full of water, the reverse is probably the case. Lack of water and consequent partial collapse of the cells perhaps accounts for this appearance. The pathological condition of these cells is probably due to the destruction, or obstruction of the vascular bundles with consequent cutting off of the water supply. The evidence which seems to support this idea is (1) the corky condition of affected tissue spreads principally along the outermost portions of the vascular network and follows coreward the larger branches of the vascular system. (2) When a bit of the water-soaked tissue is teased up in water its cells imbibe freely, swell extensively and then under the microscope exhibit the appearance of typical healthy cells. This water-soaked tissue is apparently free from fungi.

Still later in the season (about September 20) the badly affected fruits show a soft rot in the depressed areas. The depression becomes more pronounced, the skin dies and turns brown and the rot progresses rapidly coreward. The tissue is full of fungus mycelium. This soft rot is no doubt due to infection by saprophytic fungi which takes place through the weakened or broken skin. *Alternaria mali* is easily isolated from the rotten spots. Fruits usually fall soon after this soft rot sets in.

The fact that no organisms have been grown from the York Spot until the soft rot sets in points to the conclusion that the trouble is at first physiological, subsequent infection by Alternaria being responible for the rot.

In some cases only a few affected fruits can be found on a tree. Usually, however, a very large percentage of the fruit on one tree will be rendered worthless by this disease while an adjoining tree may have an almost perfect crop. The disease is no worse on weak trees than on thrifty ones. It has been found most abundantly on the fruit of young trees or on older trees which had a small crop of fruit.

Sometimes the apples are stunted when numerous spots occur on a single fruit. Others with few spots will become full sized only to be destroyed during September. Deformed fruits are common.

What effect the wetness or dryness of the season, the exposure, the soil type, or methods of cultivation have, remain to be studied. Spraying does not seem to decrease the trouble. It is as bad in well sprayed orchards as in neglected ones.

Sunburn.—The very hot weather during 1914 resulted in much sunburn on apple fruits. Those fruits which were exposed directly to the sun's rays for a greater part of the day were often injured. A browning of the epidermis resulted. Occasionally apples sunburned around the stem end fell off. Usually though, the injury was entirely superficial and the pulp under the skin sound. The light-brown color of the sunburned skin looks somewhat like a soft rot and hurts the salability of the fruit. Sunburn was more prevalent on Ben Davis than on other varieties.

Bean.

Crown Gall *(Bacterium tumefaciens)*.—Snap beans have been found badly diseased with crown gall as shown in Fig. 12.

Fig. 12.—Crown galls on a bean plant.

Maple.

Thrombotic Disease of Silver Maple.—This disease was first noticed in Frederick County in 1913, and was prevalent the following year all along the Valley Pike where silver maples are used for shade and ornament. Residents state that the trouble has been present for a number of years. Many

trees are in very bad physiological condition and some will apparently soon die as a result of attacks of this disease.

The symptoms are quite distinctive and are manifested most strikingly on the foliage. The effects of the disease are apparent as soon as the leaves unfold in spring. The leaves are yellow with a sickly appearance, growth is poor and in advanced cases nearby limbs are dead or moribund. In some cases the leaves remain yellow throughout the summer and drop in the fall

Fig 13.—Maple leaves showing the characteristic symptoms of the thrombotic disease.

somewhat earlier than those on healthy trees. Usually however, the tips die, turn brown and curl up. The leaf droops. The dying of tissue begins at the tips of the leaves and spreads toward the petiole. Usually when about half the leaf tissue has browned and curled up the leaf falls (Fig. 13). Sometimes the tips of normally green leaves die, but usually yellowing precedes the death of the tissue. The fibro-vascular bundles in affected leaves become very dark.

In dry weather the disease appears to spread slowly. In rainy weather the leaves wilt rapidly and fall in great numbers. The disease takes on the appearance of an epidemic at such times. The belief therefore arose that this was a fungus or bacterial disease, affecting the leaves and spreading

rapidly by new infections in wet weather. It was therefore known as leaf blight.

In 1913 many trees were almost defoliated by September 1. Fig. 14 shows a tree almost destitute of leaves following a rain on July 29, 1914. Trees defoliated in summer often put out new clusters of leaves on twig tips

Fig. 14.—A silver maple on July 29, almost defoliated by thromobotic disease.

late in September. The loss of leaves and warm weather cause the next year's buds to push out into activity.

It was noticed in many cases that only a portion of a tree manifested symptoms of the disease while the remainder was healthy, and that one tree might be almost dead while another adjoining it was entirely normal. This led to an investigation of the affected limbs. The wood of such limbs was

found to contain dark streaks which became bright green in contact with air. (Fig. 15.)

At a recent meeting of the American Phytopathological Society Rankin[1] described and exhibited specimens of a maple disease producing similar

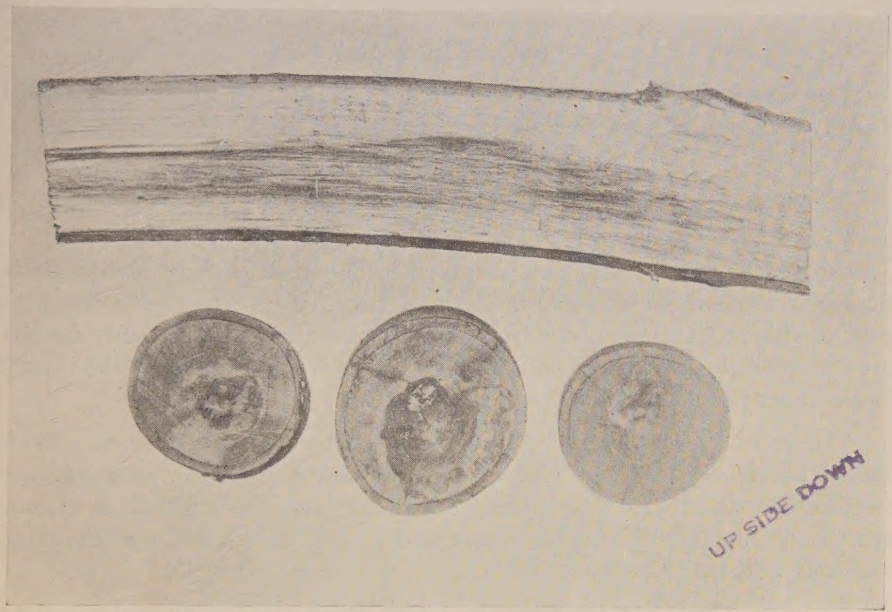

Fig. 15.—Sections of silver maple limbs showing the green strands characteristic of the thromobotic disease. In the upper left cross section the disease has just started.

green streaks in the wood. He had isolated a species of Acrostalagmus from such streaks and by inoculation reproduced the disease. He called this trouble thrombotic disease for the reason that the vasculars are plugged by the fungus, thus cutting off the transpiration stream.

Peach.

Peach Scab *(Cladosporium carpophilum)*.—In the spring of 1914 peach trees were severely injured by the scab fungus. Many trees suffered the loss of 85 percent of their twigs, which were killed back a foot to two feet from the tips, and much pruning was required for their removal.

A large part of the fruiting wood was killed. Young orchards not yet in bearing and older ones which bore no fruit on account of late frosts have been most damaged, probably because they received no summer sprays.

[1]Phytopathology. 4:395. 1914.

In the summer of 1914 some preliminary spraying experiments were carried on at Blacksburg for the control of this disease. The results obtained show that the disease on the twigs may be prevented by spraying with self-boiled lime-sulphur at intervals of fifteen to twenty days from July 1 to September 1.

Plum (Wild Goose).

PHRAGMIDIUM SUBCORTICICUM.—Plum twigs sent in from Chesterfield County were much hypertrophied and distorted.

Potato.

POTATO RHIZOCTONIA.—This disease has been collected in potato fields near Norfolk and on the Eastern shore of Virginia. From one to five per-cent of tubers were affected. Black sclerotial masses of the sterile fungus are found on the skin of the potato. The fungus is superficial and the injury to the tuber practically none.

The great injury done by this disease occurs at planting time. If infected tubers are used for seed or infected soil is used for planting, the fungus spreads to the young sprouts, which may be quickly killed. A second crop of sprouts may likewise be destroyed. Irish Cobbler is one of the most seriously affected varieties.

TIP BURN.—Potato tip burn has been attributed to strong arsenical spray material, to drouth, and to other causes. In the drouth affected localities of Virginia, tip burn has been very prevalent. The injury to the potato crop in the Shenandoah Valley in 1914 was relatively large. Early plantings of potatoes grew only about six inches high, browned and died without producing a crop. In sections of the State where rain was sufficient, tip burn was not so abundant.

Tip burn begins at the tips and edges of the leaf, progressing gradually inward. The leaf turns brown and rolls up as fast as the disease progresses. The browned tissue is brittle, readily breaks off, and is marked with fine lines parallel to the advancing zone. It is easily and often confused with the common late blight caused by *Phytophthora infestans.*

Contrasting tip burn with Phytophthora blight, the former always begins at the edge of the leaf and advances inward, producing dead, brittle, dark brown, rolled margins. The latter begins anywhere on the leaf, producing target marked, grayish-brown spots.

WILT *(Fusarium oxysporum).*—On potato plots at Blacksburg the wilt was quite abundant in 1914. It killed outright the vines of certain varieties,

Fig. 16.—Potato vines killed by wilt, (Fusarium oxysporum).

while others were affected but little. The list below shows the varieties noted and the prevalence of wilt on each, on July 23:

Irish Cobbler	None
Early Rose	"
Carman No. 3	"
Moneymaker	Slight
Peerless	"
Gold Coin	"
Spalding's Rose No. 4	"
Earliest	Pronounced
Beauty of Hebron	"
Extra Early Sunlight	"
Burbank	Bad
Green Mountain	"

Sir Walter Raleigh	Bad
Carman No. 1	"
Bliss' Triumph	All dead

HOLLOW HEART.—Examination of tubers of several varieties of potatoes at and prior to digging time in 1914, showed that a large number of the tubers were hollow at the center. This condition prevailed principally in regions where drouth was severe during the first part of the summer and rain plentiful the latter part of the season. The presence of this condition cannot be detected without cutting the tubers open. Aside from the cavity in the center they are healthy and normal in every respect. They have no tendency to rot in storage and the flesh adjacent to the hollow has no disagreeable odor or taste when cooked.

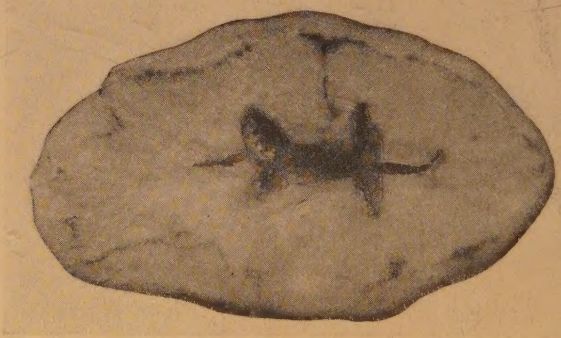

Fig. 17.—Hollow heart of potato. One longitudinal crack with two or more lateral ones is typical of this disease.

Hollow heart is attributable to drouth followed by abundant rain in the later part of the growing season. The peculiar shape of the cavities is well shown in Fig. 17.

Scale Parasite.

(Sphaerostilbe coccophila.)—Professor Schoene and Mr. Price of the Office of the State Entomologist collected at Abingdon and other points in Southwest Virginia, apple limbs infected with San José scale, which had been parasitised by *Sphaerostilbe coccophila.* All of the insects had been killed and one or more of the red conidiophore bundles of the fungus protruded from under the armor of each. Pure cultures were obtained and studied. The economic value of this fungus as a scale destroyer is probably small in most localities, but at the high altitude of Southwest Virginia with its heavy precipitation and its dewy summer nights it appears to be a common and efficient scale parasite.